Ignition Systems for Long-Term Storage and Multi-Start Capability, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

A Mars Sample Return (MSR) campaign has been identified as the critical next step in Mars science. Of the tasks needing to be accomplished, the Mars Ascent Vehicle (MAV), or means for getting the samples into orbit around Mars, is considered the highest risk. The MAV will be required to remain on the Martian surface for a year or more in order to return to Earth on a minimum energy trajectory and coordinate with the other aspects of the MSR. Environmental conditions on Mars are a significant concern, with seasonal extremes of about 110°C and 25°C. To reduce the required system mass and power related to thermal management, fuel, oxidizer, and ignition system components should be able to withstand these temperature variations. The trajectory of the MAV also has the requirement for restart capabilities. The focus of this proposal is the development of hypergolic ignition systems for MAV application. The current oxidizer of choice for the MAV is a mixed oxides of nitrogen (MON), which is a known hypergol with many fuels. The proposed solution uses metal particles (e.g., hydrides, boranes, or borohydrides) to generate ignition by injection and mixing with the oxidizer. The particles are initially housed in a sealed, pressurized chamber prior to injection. An inert gas acts as the pressurant for the particles and also serves to protect the particles from oxidation and hydrolysis during storage. Elimination of polymeric materials from the ignition train eliminates concerns of glass transition, which could lead to ignition failure in traditional pyrotechnic/pyrogen igniters. The focus of the study is the design, analysis, and testing of potential particle injection configurations and the selection of the ideal candidate particle type and morphology. At the completion of Phase I, as system ready for subscale testing in a hybrid rocket motor will be ready for implementation.

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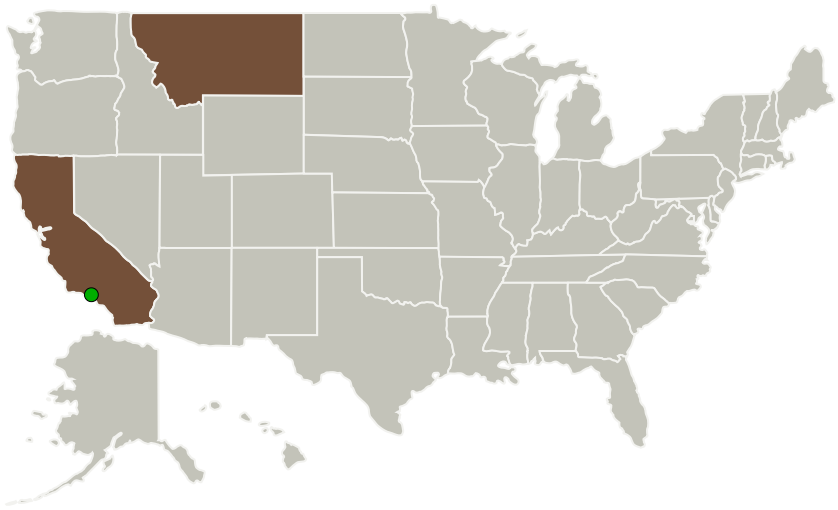
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Space Propulsion Group, Inc.	Lead Organization	Industry	San Mateo, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Montana

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139575)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Space Propulsion Group, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

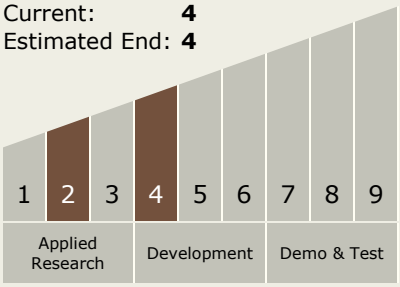
Carlos Torrez

Principal Investigator:

Brian Evans

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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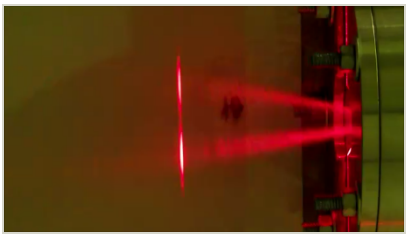
Images

Briefing Chart Image
Ignition Systems for Long-Term Storage and Multi-Start Capability, Phase I
(https://techport.nasa.gov/image/133355)



Final Summary Chart Image
Ignition Systems for Long-Term Storage and Multi-Start Capability, Phase I Project Image
(https://techport.nasa.gov/image/132865)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.5 Hybrids

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System